CLAIMS

1. A microwave circuit comprising:

a first substrate;

a first ground plate disposed on a bottom surface of said first substrate;

a second substrate attached to a top surface of said first substrate and adapted to cover a portion of said first substrate;

a second ground plate disposed on a top surface of said second substrate;

a pattern of metallization disposed between said first and second substrates to form a stripline circuit;

one or more ground paths disposed on the top surface of said first substrate and including a plurality of vias connected to said first ground plate; and

one or more openings cut into said second substrate and second ground plate, wherein each opening follows and is aligned over a portion of a ground path and is filled in with conducting material, such that said second ground plate is connected to said first ground plate.

2. The invention of Claim 1 wherein said first substrate is fabricated from high dielectric constant ceramic.

3. The invention of Claim 1 wherein said first substrate has a relative dielectric constant greater than or equal to 40.

4. The invention of Claim 1 wherein said second substrate is fabricated from high dielectric constant ceramic.

5. The invention of Claim 1 wherein said second substrate has a relative dielectric constant greater than or equal to 40.

6. The invention of Claim 1 wherein one or more regions of said first substrate are not covered by said second substrate.

7. The invention of Claim 6 wherein said microwave circuit further includes a pattern of metallization disposed on the top surface of said first substrate in one of said regions to form a microstrip circuit coupled to said stripline circuit.

8. A multi-chip module comprising:

a first substrate of high dielectric constant ceramic;

a first ground plate disposed on a bottom surface of said first substrate;

a second substrate of high dielectric constant ceramic attached to a top surface of said first substrate and adapted to cover a portion of said first substrate, wherein the portion covered by said second substrate forms a stripline region and the portion or portions not covered by said second substrate form a microstrip region;

a second ground plate disposed on a top surface of said second substrate;

a pattern of metallization disposed between said first and second substrates to form a stripline circuit;

one or more integrated circuit chips attached to said first substrate in said microstrip region; and

one or more transmission lines disposed on the top surface of said first substrate and adapted to couple said integrated circuit chips with each other and/or with said stripline circuit.

9. The invention of Claim 8 wherein said multi-chip module further includes one or more ground paths disposed on the top surface of said first substrate and including a plurality of vias connected to said first ground plate.

10. The invention of Claim 9 wherein said multi-chip module further includes one or more openings cut into said second substrate and second ground plate, wherein each opening follows and is aligned over a portion of a ground path and is filled in

with conducting material, such that said second ground plate is connected to said first ground plate.

11. The invention of Claim 8 wherein said first substrate has a relative dielectric constant greater than or equal to 40.

12. The invention of Claim 8 wherein said second substrate has a relative dielectric constant greater than or equal to 40.

13. A switched filter bank comprising:

a first substrate of high dielectric constant ceramic;

a first ground plate disposed on a bottom surface of said first substrate;

a second substrate of high dielectric constant ceramic attached to a top surface of said first substrate and adapted to cover a portion of said first substrate, wherein the portion covered by said second substrate forms a stripline region and the portion or portions not covered by said second substrate form a microstrip region;

a second ground plate disposed on a top surface of said second substrate;

a predetermined number of transmission line filters disposed between said first and second substrates;

an input port;

an output port;

a first circuit adapted to receive a control signal and in accordance therewith couple said input port with one of said filters; and

a second circuit adapted to receive a control signal and in accordance therewith couple said filter selected by said first circuit to said output port.

14. The invention of Claim 13 wherein said first circuit is implemented as a single integrated circuit.

15. The invention of Claim 14 wherein said first circuit is attached to said first substrate in said microstrip region.

16. The invention of Claim 13 wherein said second circuit is implemented as a single integrated circuit.

17. The invention of Claim 16 wherein said second circuit is attached to said first substrate in said microstrip region.

18. The invention of Claim 13 wherein said first circuit is implemented using microelectromechanical components.

19. The invention of Claim 13 wherein said second circuit is implemented using microelectromechanical components.

20. The invention of Claim 13 wherein said first circuit is a first single pole multiple throw switch.

21. The invention of Claim 20 wherein said switched filter bank further includes a plurality of transmission lines disposed on the top surface of said first substrate, each transmission line adapted to couple one of the outputs of said first switch with one of said filters.

22. The invention of Claim 13 wherein said second circuit is a second single pole multiple throw switch.

23. The invention of Claim 22 wherein said switched filter bank further includes a plurality of transmission lines disposed on the top surface of said first substrate, each transmission line adapted to couple the output of one of said filters to one of the inputs of said second switch.

24. The invention of Claim 13 wherein said switched filter bank further includes a plurality of ground paths disposed on the top surface of said first substrate and including a plurality of vias connected to said first ground plate.

25. The invention of Claim 24 wherein said ground paths are adapted to isolate said filters and transmission lines.

26. The invention of Claim 24 wherein said switched filter bank further includes one or more openings cut into said second substrate and second ground plate, wherein each opening follows and is aligned over a portion of a ground path and is filled in with conducting material, such that said second ground plate is connected to said first ground plate.

27. The invention of Claim 13 wherein said first substrate has a relative dielectric constant greater than or equal to 40.

28. The invention of Claim 13 wherein said second substrate has a relative dielectric constant greater than or equal to 40.

29. The invention of Claim 13 wherein at least one of said filters is an interdigital structure.

30. The invention of Claim 13 wherein at least one of said filters is a zig-zag edge coupled filter comprising a plurality of open-ended transmission line resonators, wherein half of a resonator line is coupled to an adjacent line on one side and the other half of the resonator line coupled to an adjacent line on the other side, and each resonator is bent at a predetermined angle.

31. The invention of Claim 30 wherein said predetermined angle is 90 degrees.

32. An edge coupled filter comprising:

a dielectric substrate and

a plurality of open-ended transmission line resonators disposed on a top surface of said substrate, wherein half of a resonator line is coupled to an adjacent line on one side and the other half of the resonator line coupled to an adjacent line on the other side, and each resonator is bent at a predetermined angle.

33. The invention of Claim 32 wherein said predetermined angle is 90 degrees.

34. A switch comprising:

a substrate;

an input transmission line disposed on a top surface of said substrate;

a predetermined number of output transmission lines disposed on the top surface of said substrate, wherein said predetermined number is greater than two; and

a predetermined number of microelectromechanical switching units disposed on said substrate, each switching unit adapted to receive a control signal and in accordance therewith couple said input transmission line to one of said output transmission lines.

35. The invention of Claim 34 wherein said switch is configured as a single pole multiple throw switch.

36. The invention of Claim 34 wherein said predetermined number is four.

37. The invention of Claim 36 wherein said input transmission line is coupled to a first port of a four port junction.

38. The invention of Claim 37 wherein second and third opposing ports of said four port junction are coupled to the inputs of a first switching unit and a second switching unit, respectively.

39. The invention of Claim 38 wherein a fourth port of said four port junction, opposite said first port, is coupled to a first port of a three port junction by a transmission line.

40. The invention of Claim 39 wherein second and third opposing ports of said three port junction are coupled to the inputs of a third switching unit and a fourth switching unit, respectively.

41. The invention of Claim 40 wherein each switching unit includes a switch input line and a switch output line disposed on said substrate, and an armature attached to said substrate at one end and a switch transmission line disposed on a second end, wherein said second end is positioned above said switch input and switch output when said switching unit is open, and said second end is lowered such that said switch transmission line couples said switch input to said switch output when said switching unit is closed.

42. The invention of Claim 41 wherein each switching unit further includes a substrate electrode disposed on said substrate under said armature, and an armature electrode disposed on said armature above said first electrode.

43. The invention of Claim 42 wherein said first and second electrodes are adapted to receive a bias voltage and in accordance therewith open or close said switching unit.

44. The invention of Claim 43 wherein said switch further includes a plurality of bias pads for supplying said bias voltages to said switching units.

45. The invention of Claim 44 wherein a single bias pad is connected to an electrode of said third switching unit and an electrode of said fourth switching unit.

46. The invention of Claim 45 wherein a single bias pad is connected to the substrate electrodes of said third and fourth switching units.

47. The invention of Claim 45 wherein a single bias pad is connected to the armature electrodes of said third and fourth switching units.

48. The invention of Claim 34 wherein said switch has an isolation of greater than about 25 dB over the frequency range of about 0 to 20 GHz.

49. The invention of Claim 34 wherein said switch has an insertion loss of less than about 0.6 dB over the frequency range of about 0 to 20 GHz.

50. A method for switching an input signal to a selected output port from a plurality of output ports comprising the steps of:

applying said input signal to a monolithic microelectromechanical switch comprising:

a substrate;

an input transmission line disposed on a top surface of said substrate;

a predetermined number of output transmission lines disposed on the top surface of said substrate, wherein said predetermined number is greater than two; and

a predetermined number of microelectromechanical switching units disposed on said substrate, each switching unit adapted to receive a bias voltage and in accordance therewith couple said input transmission line to one of said output transmission lines;

connecting each of said output transmission lines to one of said output ports; and

applying a bias voltage to each of said switching units such that a switching unit coupled to said selected output port is closed and the other switching units are open.

51. A method for fabricating a microwave circuit including the steps of:

attaching a first ground plate to a bottom surface of said first substrate;

etching a pattern of metallization on a top surface of said first substrate to form a desired circuit;

drilling a plurality of vias through said first substrate and filling them with conductive material to form one or more ground paths on the top surface of said first substrate;

attaching a second ground plate on a top surface of a second substrate adapted to cover a portion of said first substrate;

cutting one or more openings into said second substrate and second ground plate, wherein each opening follows a portion of a ground path;

attaching said second substrate to said first substrate such that said openings are aligned over said ground paths; and

filling in said openings with conductive material, such that said second ground plate is connected to said first ground plate.